Homework #1

Problem 1:

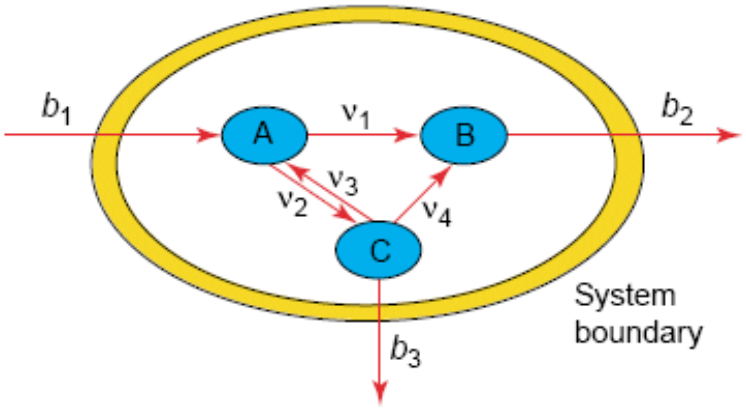
Consider the Michaelis Menten reaction scheme which includes an intermediate:

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftarrows}} ES \xrightarrow{k_2} EI \xrightarrow{k_3} E + P$$

Derive the rate expression by making the common assumptions for the Michaelis Menten kinetics.

Problem 2:

You are given the following reaction network (Note: the notation is a bit different from what was used in class, however, since many people use different notation it is good to get used to this early. Here all fluxes are assumed to be positive):



a) Derive the dynamic model describing this system.
b) What is the stoichiometric matrix N?
c) Assume that you are given values for b1, b2, and b3. How many different potential solutions for the fluxes do you have?
d) Let's assume that we drop the assumption that all fluxes have to be positive. In what way would this change the diagram shown above?

Problem 3:

You spent the last weekend setting up the fluxes for a reaction network and determined that it has the following stoichiometric matrix:

$$\begin{bmatrix} -1 & 0 & 0 & 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ 1 & -1 & 1 & 0 & 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 1 & -1 & -1 & 1 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & -1 & 0 & 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & -1 \end{bmatrix}$$

One of your co-workers tried to measure the fluxes and came up with the following:

$$v = \begin{bmatrix} 4 \\ 2 \\ 0 \\ 1 \\ 0 \\ 1 \\ -4 \\ 2 \\ 1 \\ 1 \end{bmatrix}$$

Is his result potentially correct? If not, then what would be a possible result?